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EyeWorld
VOLUME 8, NUMBER 2 The News Magazine of the American Society of Cataract & Refractive Surgery FEBRUARY 2003

Wavefront aberrometry *helps in figuring out best treatment options*

Wavefront aberrometry is changing our current viewpoint in refractive surgery and I have been using it to determine refractive treatment options, preoperatively as well as postoperatively.

Having worked with possibly every refractive surgical technology, both in the United States and abroad, I can foresee the use of this exciting technology in the entire spectrum of refractive surgery, and we haven't even yet scratched the surface.

In LASIK surgery, as we evolve toward delivering super vision, we can see identifiable patterns that can help surgeons determine whether a patient's best option is routine LASIK, wavefront-guided LASIK, or no treatment at all. That's imperative because there are repeatable patterns in preopLASIK candidates that clearly show patients who should not be corrected. If a patient's vision is corrected, he or she would likely be unsatisfied.

Having performed wavefront-guided LASIK surgery abroad before the U.S. Food and Drug Administration's approval, I am confident that wavefront guidance is a higher level of delivery, because it produces excellent results. It also has a future in the diagnoses of many patients who cannot be evaluated with standard topography, even patients who are 20/20 postop, but still have vision quality problems that are not discernible with topography.

I currently use the Bausch & Lomb Dual Head Zywave system.

Just say no

The use of wavefront aberrometry allows surgeons and their patients to decide whether a procedure that corrects wavefront aberrations would enhance or diminish vision. However, it is important to note that not every wavefront aberration is a hindrance to good vision. In some cases, the wavefront aberrations tend to cancel each other out. For example, in some satisfied LASIK patients who still have wavefront aberrations, simulation to correct all the aberrations with wavefront-guided LASIK shows that their vision would worsen.

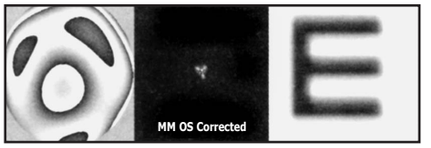
Although wavefront is an exciting technology, the facts must be separated from the hype. The technology must be broken down into simplified language that all eye surgeons can understand and apply in their everyday practice for routine clinical use.

Case studies

The cases discussed below illustrate LASIK patients who are 20/20 postop with various levels of satisfaction. Identifiable patterns appear in these patients. Fourier Transform Convolution (FTC) has been used to simulate their final visual outcome.

I would like to acknowledge Ian Cox, B. Optom, PhD, University of Rochester, for his collaboration in this work.

Patient MM OS



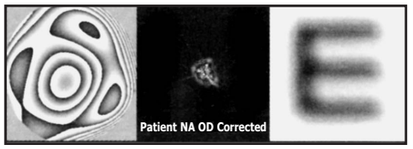
Patient MM OS corrected

This patient is a high myope with astigmatism who had LASIK OU with resultant 20/20 vision. The wavefront aberrometry revealed a comet-shaped point-spread function (coma involved). The patient's vision was blurry, as seen in the "E" at the right, resulting in complaints of night vision. On correcting for defocus and astigmatism on Fourier transform, we see a resultant trefoil (which most likely is coupling the coma) with an improved vision and hence what this patient needs is simple astigmatic LASIK surgery.

The postop wavefront will always show the trefoil among higher order

aberrations. No need for wavefront-guided surgery here, just correcting the astigmatism will improve vision to acceptable levels.

Patient NA OD



Patient NA OD corrected

This patient is 20/20 post-LASIK. The wavefront aberrometry revealed a kidney-shaped pattern indicating myopia with astigmatism. The point-spread function and "E" were both distorted. Myopia with astigmatism was picked up on the wavefront system.

After correction for defocus and astigmatism by FTC, the point-spread function and the "E" both improved. In this case, the patient needs a simple myopic-with- astigmatism LASIK touch-up, not a wavefront correction. The touch up would correct the point spread function to a point where the "E" would be sharper.

Patient JB OD

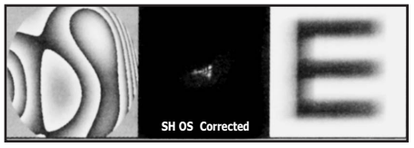
Patient JB OD corrected

Patient JB OD is 20/20 post-LASIK. The wavefront aberrometry revealed an oval-shape that indicated astigmatism. The oval was not symmetric, so most likely coma is suspect here. Spherical aberration was also present. The point-spread function had two streaks and the "E" was not clear because of ghosting at about 45 degrees.

The patient complained of night vision problems. For night vision function, the appearance (either streaks or glare/star burst) is important. If the patient indicates streaks, as this one did, I treat the astigmatism with normal LASIK. However, if a starburst is indicated, a custornized wavefront-guided LASIK is most likely needed.

In this case, one would proceed with simple touch-up astigmatic LASIK, and only if the patient still has complaints and higher order aberrations are documented, would recommend wavefront-guided LASIK.

Patient SH OD

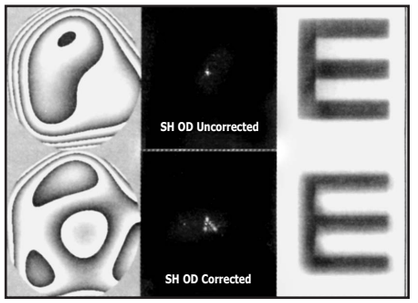


SH OD preop and corrected

This patient also is 20/20 OU post-LASIK. The wavefront aberrometry indicated spherical aberration, astigmatism, and coma. The point-spread function was tight and the "E" looked adequate. If a surgeon would attempt to treat the higher order aberrations here, the result would be unacceptable to the patient. The wavefront simulation shows that the point-spread function would be distorted and the "E" would become worse with double line on each side of letter.

This case illustrates that even though a surgeon may find a wavefront aberration, it does not need to be treated.

Patient SH OS



SH OS corrected

This patient with 20/20 post LASIK vision complained of night vision problems that resulted in a starburst effect. The wavefront system showed spherical aberrations, astigmatism, and coma. The "E" was blurry, and the point-spread function was also a blur.

Compensating for defocus and astigmatism on wavefront simulation, we can see that the "E" will clear but a comet-shaped pointspread function (depicting coma with trefoil) would be induced, In this case, the wavefront treatment would induce a wavefront aberration, however vision will also be improved.

Wavefront technology can thus be used to better understand and evaluate visual consequences of refractive surgery both, before and after surgery.

About the Physician

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